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The study of learners' critical thinking potential, learning with innovation enhancing thinking potential

Sumalee Chaijaroen [a*], Issara Kanjug[b], Charuni Samat[c]

[a] *Department of Educational Technology, Faculty of Education, Khon Kaen University,40002, Thailand*
[b] *Department of Educational Technology, Faculty of Education, Khon Kaen University,40002, Thailand*
[c] *Department of Computer Education, Faculty of Education, Khon Kaen University,40002, Thailand*

Abstract

This study was aimed at designing and developing an innovation, to examine and enhance critical thinking. The target group consisted of 35 sixth-grade students studying during the first semester of academic year 2006 at Nong Ta Kai School, Nong Ruea, Khon Kaen. A one-shot case study was employed and the qualitative approach was applied to analyze the data. The results are the following.1. The design and development of the learning innovation was based on constructivist theories and media attribution which included several important components, namely, 1) problem-based learning, 2) learning resources, 3) collaborative learning, 4) scaffoldings, and 5) coaching to encourage critical thinking and knowledge construction of the learners. 2. Critical thinking involves 6 kinds of abilities: 1) argument analysis, 2) judging the credibility of sources, 3) appraisal of an observation report, 4) deductive reasoning and making judgments, 5) inductive reasoning and making judgments, and 6) appraisal of the judgments.

Keywords: Constructivist theories, Critical thinking, Learning innovation, argument analysis, judging the credibility of sources, appraisal of an observation report, deductive reasoning and making judgments, inductive reasoning and making judgments, and appraisal of the judgments. .

1. Introduction

Currently, Thai society is experiencing several rapidly occurring changes because of the advancements in technology, communications, transportation, information technology, as well as the diffusion of transnational cultures and economic competition. In order to respond to and keep pace with these changes, educational development, particularly human resource development, is essential. Consequently, Thai society must review its educational system and make it conducive to developing "human" resources to have the knowledge and abilities necessary in the age of globalization, and meaningful for economic, political and social development. In this connection, it is necessary to have educational reform that focuses on endowing people with the quality and potential needed to compete with other countries the world over.

From these reasons, it will be seen that educational management responding to social changes and sustainable human resource development is essential. This is not only for the purposes of creating a better life, a higher quality of life, or to educate people to have knowledge and ability, but also to enable people to survive sustainably, both as individuals and as part of society. The most important and necessary foundation is an environment that stimulates

* Chaijaroen, Sumalee. Tel.: +6-687-214-5123
E-mail address: *sumalee@kku.ac.th*

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learners to perceive the thinking process and know how to think constructively. When they have the ability to think, the process of thinking will be with them throughout their lives and become an instrument that will help them to take care of themselves. Therefore, it is necessary to develop human resources to know the right way to think and make the right decisions in diverse situations, and to be able to develop themselves and create new innovations so as to exist independently in the future Charoenwongsak Kriengsak (2003), in response to the intent of the Education Act, 1999, Article 24 regarding the learning process aiming at practicing skills, the thinking process, management, and applying such knowledge to improve national education standards. Especially relevant is Article 4, referring to the fundamental education level, which focused on creation of the learner's ability to think analytically, synthetically, creatively and cognitively.

In particular, the management of science subjects is intended to create new knowledge by allowing the learners to participate, do the experiment, and develop ways of thinking, including rational thinking. Hopefully, in this way the learners will be able to make reasonable arguments. In addition, they will have the ability to solve problems systematically, judge the credibility of sources, and use it as criteria for decision-making.

In this present study, the learners had to learn about certain chemicals in daily life and use their ability to analyze a diverse range of data to make the right decisions. This is consistent with the critical thinking of Ennis (2000), which consists of 6 kinds of abilities: 1) argument analysis, 2) judging the credibility of sources, 3) appraisal of an observation report, 4) deductive reasoning and making judgments, 5) inductive reasoning and making judgments, and 6) appraisal of the judgments.

Based on the above principles, the research team adopted the critical thinking, constructivist theory and the characteristics of the media, including the symbols system, synthesizing them as the framework for designing the learning innovation. It is thought to be conducive to promoting critical thinking abilities through a series of designs to build a body of knowledge based on the principles of integrated media, including texts, videos, local wisdom, and experimental equipment.

2. Concepts and Theories

Education at all levels must promote critical thinking and encourage learners to develop their full potential. Therefore, learning should focus on the knowledge construction based on the theories of cognitivism, constructivism, and critical thinking. Other features include integrated media technology, the principles of multimedia design called knowledge construction, and learning innovations to further promote critical thinking ability.

3. The Purpose of This Study

This study was aimed at 1) designing and developing a learning innovation to enhance critical thinking, and 2) examining the critical thinking of the learners.

4. The Target Group of This Study

The target group consisted of 35 sixth grade students who were studying in the first semester of academic year 2006 at Nong Ta Kai School, Nong Ruea District, Khon Kaen Province.

5. Research Design

The pre-experimental design, particularly a one-shot case study, was employed.

X O

X=Learning with the learning innovation to enhance critical thinking.

O= Critical Thinking

6. Research Variables

Independent variables consisted of the innovation to enhance critical thinking.
Dependent variables consisted of critical thinking of the learners.

7. Research Instruments

The instruments in this study consisted of the following: the innovation to enhance learners' thinking potential and the instruments to collect data. They are described below.

1. The learning innovation to enhance critical thinking

The learning innovation was designed and constructed as follows: the researcher examined and analyzed principles, theories, and research related to learning to enhance critical thinking as well as contextual studies. It was based on the above mentioned study concerning (1) principles of critical thinking, (2) cognitive constructivism and social constructivism, and (3) media attribution and media symbol system. The designing framework of the innovation was synthesized and the following six essential components were utilized: (1) problem-based learning, (2) resources, (3) discovery learning, (4) scaffolding, (5) collaborative learning, and (6) coaching.

The efficiency of the learning innovation in enhancing critical thinking was assessed according to the following 4 dimensions: 1) product quality, 2) contextual utilization, 3) learners' opinions of the learning innovation, and 4) critical thinking ability.

2. The instruments for collecting data were both quantitative and qualitative data, as described below: The researchers constructed a critical thinking interview form for the learners. It was an unstructured interview form which framework was based on the critical thinking described by Ennis (2000). It included the following elements: (1) argument analysis,(2) credibility of sources, (3) appraisal of an observation report, (4) deductive reasoning and making judgments, (5) inductive reasoning and making judgments, and (6) appraisal of the judgements.

8. Data Collection and Analysis

In this study, the researchers conducted experiments and collected data in the science room at Ban Nong Ta Kai School, Nong Ruea District, Khon Kaen Province to study critical thinking regarding chemicals in daily life of a Grade 6 science class, and the process of data collection follows.

To provide the learners with learning and innovation, the procedures were as follows:

1) The learners were divided into 13 small groups, each of which had three students from different grades.

2) The learners were provided with an innovative learning technique. Details are as follows:

(a) Learners studied the problem

(b) Learners used collaborative learning problem solving and sought knowledge and information from the resources provided in the learning innovation and the database, as well as through other external sources, such as contacting an expert, exchanging multiple perspectives, or finding answers from a variety of other groups.

3) The experts checked the answers. If the learners misunderstood something or had misconception, the experts would urge them to figure out a way to solve problems and ask precise questions to activate them to think.

4) The learners and the teachers discussed and summarized the learning concepts. The teachers encouraged the learners to elaborate or to articulated something that they constructed their own understanding; the teachers also provided guidance if the learners had any questions, and made suggestions if learners had misconceptions.

After learning with the innovation, the learners were interviewed about critical thinking. The protocol analysis and the analytic description and interpretation were employed to analyze critical thinking of the learners in the framework of applying the basic critical thinking of Ennis (2000), which can be summarized as follows: 1) argument analysis, 2) credibility of sources, 3) appraisal of an observation report, 4) deductive reasoning and making judgments, 5) inductive reasoning and making judgments, and 6) appraisal of the judgments.

9. Research Results and Discussion

The construction of the learning innovation to enhance critical thinking was based on the designing framework, the details of which are illustrated in Diagram 1. It consists of the following 6 components: 1) problem-based learning, 2) resources, 3) discovery learning, 4) scaffolding, 5) collaborative learning, and 6) coaching.

The efficiency of the learning innovation was revealed in the following dimensions: 1)The expert review showed that the design of the learning innovation was appropriate and congruent with the underlined theories and principles mentioned above which can enhance critical thinking. 2) The learners' opinions showed that the learning innovation was appropriate and that it helped them in the learning process. Moreover, they preferred learning with this innovation and it stimulated them to think and discover the answers.

10. The Critical Thinking of the Learners

The learners' critical thinking was found in 6 kinds of abilities: 1) argument analysis, 2) credibility of sources, 3) appraisal of an observation report, 4) deductive reasoning and making judgments, 5) inductive reasoning and making judgments, and 6) appraisal of the judgments. This finding is congruent with Srichai Arunsri and Chaijaroen Sumalee (2005); Kong-aim Kritayanee and Chaijaroen Sumalee (2007), Angeli, Charoula and Valanides, Nicos. (2009).

The above findings may be the result of the instruction design used in this study. The crucial theories used as the foundation of the design and development of the learning innovation were critical thinking, constructivist theories and cognitive theories. This reason can be illustrated by the empirical evidence from the expert reviews, as seen below:

"The design of the learning innovation was appropriate and congruent with underlined theories and principles (critical thinking and constructivist theories)."

"The instruction design: ID Theory, especially critical thinking, was used to design learning tasks for the learners (e.g., problem-based learning); this may help to enhance the learners' critical thinking during the process of learning." In addition, some of examples of empirical evidences can support the above findings as follows:

9.1 Argument analysis:

The argument that the learners can analyze the reasons for the decision about the credibility of the source as a basis for determining disputed claims. For example, the learners were able to argue the claims made by reason of the sources of information. For example, the first speaker was a cosmetics sales person, not a skin specialist. Therefore, claims such as, "Cosmetics are applied to the face for 3 days," are not credible. The advertising can be an exaggeration, because advertisers want to sell products. In addition, learners can use logic and facts to consider and argue the claim that cosmetics whiten the face within 3 days, and argue that it may contain harmful chemicals.

This is shown by empirical evidence from the interviews. Examples are:

"The first speaker's words are not reliable; this person is not a skin specialist, but a cosmetics sales person. The claim that the complexion becomes white within 3 days is not likely to be true." Or, "do not believe the first speaker, it may be an exaggeration just to sell the product" or " it is an exaggeration to say that that skin can be whitened within 3 days; it is very difficult to do this." These findings are consistent with Srichai Arunsri and Chaijaroen Sumalee (2005); Kong-aim Kritayanee and Chaijaroen Sumalee (2007), Angeli, Charoula and Valanides, Nicos. (2009).This finding supports the principles of critical thinking of Ennis (2000).

9.2 The credibility of sources:

The learners were able to judge the credibility of the two sources of information. They considered the source of the information of the credibility of the second speaker, such details about this person's knowledge, experience and expertise in such matters. For example, the learners judged the credibility of the selection of cosmetics based on the recommendations of the advertiser, showing that learners can judge the credibility of data sources. The majority of the learners choose to use the ideas of a skin specialist in judging the credibility of information based on the expertise of the speaker.

This can be seen from the empirical evidence obtained from interviews with the learners. Examples are,
"Believe an expert because it is determined by a large study;" "Believe the second speaker because he is a skin expert"; "Believe the second speaker because he warns us to protect ourselves, and he is also a skin specialist, which makes him more reliable"; or "Believe the second speaker because he is an expert on skincare. Having knowledge and experience to avoid face turn as dark spots from the use of cosmetics"; "Believe the second speaker because he has knowledge of the principles of reliable cosmetics."

These findings are consistent with Srichai Arunsri and Chaijaroen Sumalee (2005); Kong-aim Kritayanee and Chaijaroen Sumalee (2007), Angeli, Charoula and Valanides, Nicos. (2009) and also support the principles of critical thinking regarding the credibility of the sources (Ennis, 2000).

9.3 Inductive reasoning and making judgment:

The learners can use deductive reasoning and judgments, such as articulating reasons for selecting cosmetics and how to use them safely. This is evident from the results of the interviews detailing what they used as a basis to consider. It can be concluded that the inductive principle is used to infer that the cosmetic is safe, based on whether the product label indicates valid measurements of its ingredients as well as a trademark of TIS (Trademark of Industry Standard), which is guaranteed by the Food and Drug Administration. It shows that the learners are able to make good judgments. This can be seen from the empirical evidences of the interviews. Some examples are the following:

"The label on the box/bottle must have a seal of certification ensuring that it has been verified by the Food and Drug Commission."

"Try using the cosmetic on the skin to check for an allergic reaction, if there is no reaction, keep on using it, but if there is reaction, stop using it immediately." "The label should be in good condition." "As with any drug, use with caution and follow the directions." "If the ingredients contain mercury, do not use the product." "Check the date of manufacture and expiration. If it is expired, it cannot be used."

These findings are consistent with Srichai Arunsri and Chaijaroen Sumalee (2005); Kong-aim Kritayanee and Chaijaroen Sumalee (2007), Angeli, Charoula and Valanides, Nicos. (2009) and also support the principles of critical thinking regarding the principles of critical thinking and inductive reasoning and making judgments of Ennis (2000).

10. Recommendations for Research

10.1. Studying all components, such as problematic situations, and scaffolding design to be used in designing learning innovations that promote critical thinking abilities.
10.2 Examining critical thinking mechanisms in order to be guideline for promoting in-depth cognitive process that can help develop critical thinking ability.

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